**IMAYAM ARTS AND SCIENCE COLLEGE**

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**DEPARTMENT OF CHEMISTRY**

**Subject: PHYSICAL CHEMISTRY – II**

**Subject Code: 16SCCCH9**

***UNIT – I***

***2 Marks***

1. **Specific Conductance (**κ)

The reciprocal of specific resistance is called specific conductance.

κ = 1/ρ

1. **Equivalent Conductance**

Equivalent conductance is defined as the one gram of equivalent electrolyte present in one cc volume of solution.

ʌ = κV

1. **Molar conductance**

Molar conductance is defined as one mole of the electrolyte present in the one cc volume of the solution.

μ = κV = κ \* (1000/M)

1. **Common ion effect**

The common ion effect is an effect that suppresses the ionization of an electrolyte when another electrolyte which contains an same ion is added**.**

1. **Kohlarusch’s law**

At infinite dilution, each ion contributes a definite amount to the total conductance of the electrolyte, irrespective of the nature of the ions.

ʌm = λ+ + λ-

1. **Transport number**

The fraction of the total current carried by each kind of ion is called its transport number or transference number.

1. **Hittorf’s rule**

The concentration change is directly proportional to the velocities of ions.

1. **Conductometric titration**

The principle involved is that electrical conductance depends upon the number and mobility of ions.

1. **Specific Resistance (**ρ)

The resistanc of a conductor is directly proportional to its length (l) and inversely proportional to its area of cross section (a).

R ᾳ l/ρ ; R = ρ (l/a)

***UNIT – II***

1. **Electrochemical cell**

Electrical energy is converted into chemical energy is called as Electrochemical cell.

1. **Galvanic cell**

A galvanic cell is a device in which the free energy of a physical energy or chemiscal energy is converted into electrical energy

1. **Reversible cell**

Reversible cells are those in which reversible reactions are involved these cells can brought back to their initial state by applying external potential difference

Ex : Daniel Cell

1. **Irreversible cell**

Irreversible cells are those which require replacement of chemicals when they given out electricity.

Ex : Dry cell.

1. **Reference electrode**

A reference electrode is an electrode which has a stable and well known electrode potential.

Ex : Ag – Ag electrode, calomel electrode.

1. **Standard hydrogen electrode**

These electrodes consist of purified hydrogen gas passed through a 1 M solution of hydrogen ions at 1atm pressure.

1. **Corrosion**

Corrosion is defined as the damage or destruction of material due to chemical or electrochemical and environmental reaction**.**

1. **Single electrode potential**

The tendency of an electrode to lose or gain electrons when it is contact with its own ions in solution is called electrode potential.

Electron gain means tendency to get reduced – reduction potential

Electron lose means tendency to get oxidized - oxidation potential

1. **Calomel electrode**

Calomel electrode consists of mercury, solid mercurous chloride and a solution of potassium chloride. The electrode is represented as Hg, Hg2Cl2(s); KCl (solution).

1. **Standard electrode potential**

The potential of an electrode at a given temperature depends upon the concentration of the ion in the surrounding solution. If the concentration of the ions is unity and the temperature is 250C, the potential of the electrode is termed as the standard electrode potential.

***UNIT - III***

1. **Define Catalysts**

A catalyst is defined as a substance which increases the rate of the reaction without undergoing any change and can be recovered as such at the completion of the reaction.

1. **Types of catalyst**

Two types - Homogeneous catalysis

Heterogeneous catalysis

1. **Homogenous catalyst**

The catalyst and the reactants form a single phase is called homogenous catalyst

1. **Heterogeneous catalyst**

The catalyst and the reactants form at different phase is called heterogenous catalyst.

1. **Auto catalyst**

Auto catalyst is self catalysis in this process one of the product formed act as a catalyst and increase the reaction rate.

1. **Poison catalyst**

Substance which decrease the catalyst activity are known as catalyst poisons or inhibitors.

1. **Enzyme catalyst**

Catalytic reaction is catalyzed by certain complex organic substance is called as enzyme catalyst. Most enzymes are proteins, and most such processes are chemical reaction.

1. **Catalytic promoters**

A substance which increase the catalyst activity are known as promoters.

1. **Positive and negative catalyst**

Catalysts which increase the rate of chemical reaction are positive catalyst while decrease the rate of the reaction are negative catalyst.

***UNIT IV***

1. **Selction rule for microwave spectroscopy**

Molecule possess a permanent dipole moment are shown in microwave region.

ΔJ = ±1

1. **Rotational constant**

B = h/(8π2Ic) cm-1

1. **Condition to be active microwave**

Heteronuclear diatomic molecule like HCl are possess dipole moment show microwave spectra. Homonuclear diatomic molecule like H2, Cl2 do not possess a dipole moment do not show microwave spectra.

1. **Selection rule for IR**

Δν= ±1

1. **Condition to be active IR**

Dipole moment of the molecule must change during the vibration.

Homonuclear diatomic molecule do not have a permanent dipole moment nor does the stretching of the bond between the atoms change the dipole moment are show IR spectra.

1. **UV spectroscopy**

UV spectroscopy is an electronic spectroscopy when the transition takes place between the electronic transition energy level. They occurs in visible and UV region.

1. **Franck codon principle**

The electronic transition takes place so rapidly that a vibrating molecules does not change its internuclear distance appreciably during the transition.

1. **Force constant**

V = (1/2π) (k/m)1/2

1. **Fundamental vibrational frequency**

At room temperature most of the molecule in ground state (v=0) so the transition takes place from v=0 to v=1 is called fundamental vibrational frequency.

1. **Overtones and hot bands**

An over tone bands is the spectral bad that occurs in a vibrational spectrum of a molecule when the molecule makes transition from the ground state (v=0) to the second excited state (v=2).

Hot bands is a band centred on a hot transition, which is a transition between two excited vibrational states i.e neiter is the overall ground state.

1. **Zero point energy**

The energy of the lowest vibrational level of the oscillator is not zero but is equal to (1/2hν), this is called zero point energy.

***UNIT – V***

1. **Raman effect.**

Scattering light has frequencies higher or lower than the incident frequency. The scattering which occurs with change in the frequency of the incident radiation. This phenomenon is called raman effect

1. **Stokes lines**

The frequency of the incident light will be more than that of the scattered light we get lines on the lower frequency side of the incidient light. These are called stokes lines.

νR = νi - νs  Positive

Strokes lines are more intense than incident light.

1. **Anti stokes line**

The frequency of the incident light will be less than that of the scattered light we get lines on the higher frequency side of the incidient light. These are called stokes lines.

νR = νi - νs  Negative

Anti Strokes lines are less intense than incident light.

1. **Raman frequency**

The difference between the frequency of the incident light and frequency of the scattered light is called Raman frequency.

1. **Selection rule**

Raman spectra exhibit there is a change in the polarizability or molecule during rotation or vibration. ΔJ = 0 or ±2, ΔV = 0, ±1, ±2

1. **Rayleigh scattering**

When a monochromatic light scattered by molecules, most of emerging light has tha same frequency of the incident light, this process is called Rayleigh Scattering.

1. **NMR spectroscopy Principle**

NMR is a branch of spectroscopy in which radiation of radiowave frequency is absorbed by spinning nucleus. This involves the magnetic energy of nuclei when they are placed in a magnetic field and the transition occur in the region of the spectrum.

1. **Chemical shift**

The difference between the magnitudes of the magnetic field at which free nuclei and molecular nuclei resonate is called chemical shift.

1. **Rules for splitting of NMR signals**

Equivalent nuclei do not interact with one another.

If there are ‘n’ proton in the adjacent carbon atom, then multiplicity is given by (n+1).

1. **Coupling Constant J**

The distance between peaks in a multiplet is called the coupling constant.

1. **Splitting of signals**

The NMR signals for a set of equivalent protons are found to split into several signals. The splitting NMR signals is caused due to spin-spin coupling.

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***UNIT – I***

***5Marks***

1. **Derive Ostwald dilution law.**
2. **Explain effect of equivalent conductance**
3. **Determine the transport number**
4. **Describe the moving boundary methods**
5. **Explain Kohlarusch’s law and its applications**
6. **Determine the transport number by hittorf rule.**
7. **Explain the application of conductivity measurement**
8. **Detailed notes on acid-base titration.**

***10 Marks***

1. **Give an account of Debye Huckle onsager equation**
2. **Write detail notes on conductometric titration**
3. **Give an detailed notes on Arrhenius Theory**
4. **Explain common ion effect and its application**
5. **Explain the transport number by hittorf’s method**

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***UNIT – II***

**5 Marks**

1. **Explain the conventional representation of Electrochemical cell**
2. **Derive nersnt equation**
3. **Discuss the electrochemical series.**
4. **Explain the reference and redox electrodes**
5. **Explain standard hydrogen electrode**
6. **Explain the prevention methods of corrossion**
7. **Explain the types of Corrosion**
8. **Explain the redox titration**
9. **What are the prevention methods in corrosion - explain**
10. **Explain the electrode reaction / galvanic cell**

***10 Marks***

1. **Give an account on types of reversible electrode reaction.**
2. **Discuss on potentiometric titration**
3. **Explain the thermodynamic quantities of electrochemical reaction**
4. **Write notes on corrosion.**

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***UNIT – III***

***5 Marks***

1. **Dicsuss the characteristic of Catalysts**
2. **Explain the types of catalyst**
3. **Discuss the adsorption theory of catalytic reaction**
4. **Write short notes on compound formation theory.**
5. **What is Homogenous catalyst? Explain with suitable examples.**
6. **What is Heterogeneous catalyst? Explain with suitable examples**
7. **Explain the types of adsorption .**
8. **Write short notes on Freundlich isotherm**
9. **Difference between the phisicaladsorption and chemisorptions.**

***10Marks***

1. **Detail notes on adsorption Isotherm.**
2. **Derive the Michal’s menten Law**
3. **Derive the Langumuir adsorption Isotherm**
4. **Discuss the detailed notes on theory of catalysis.**
5. **Explain the characteristic of adsorption.**

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***UNIT IV***

***5 Marks***

1. **What are the Selction rule for microwave spectroscopy**
2. **What is meant by Rotational constant. How it can be determine.**
3. **Explain Condition to be active the molecule in microwave region**
4. **What are the Selection rule for IR**
5. **Discuss the types of vibration molecules in IR**
6. **Explain UV spectroscopy**
7. **Discuss the Franck codon principle**
8. **Explain the predissiociation in UV**
9. **What is meant by Fundamental bands? How it can be identify in IR**
10. **Explain Overtones and hot bands and zero point energy**

***10 Marks***

1. **Show that for a rigid diatomic rotor in microwave region**
2. **Explain the IR spectroscopy**
3. **Explain the vibration of diatomic molecule/ simple oscillator in IR – region**
4. **Discuss the application of UV Spectroscopy.**

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***UNIT – V***

***5 Marks***

1. **Explain Raman frequency**
2. **Discuss difference between the Stokes lines and Anti stokes line**
3. **Explain the quantum theory of raman effect**
4. **Explain the Mutual Exclusion Principle.**
5. **Explain NMR spectrocopy**
6. **Comparison of Raman and IR Spectra**
7. **Discuss the advantage of Raman spectra over IR spectra.**

***10Marks***

1. **Explain the structural determination of Raman Spectra**
2. **Explain NMR spectroscopy and its application**
3. **Explain the theory of NMR**
4. **Difference between the IR and Raman spectroscopy.**
5. **Mutual exclusion rule**
6. **Reason for IR inactive and Raman active – explain?**